

## AMENDED SPECIFICATION

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# PATENT SPECIFICATION (11) B1 462 409

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### (54) IMPROVEMENTS IN OR RELATING TO BLIND RIVET ASSEMBLIES

(71) We, MECANO - SIMMONDS GMBH, a German Company, of 6900 Heidelberg 1, Dischinger Strasse 9, Germany, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to a blind rivet assembly, for example, serving as fixing elements, for blind riveting or blind fastening of fixing elements to workpieces such as e.g. metal sheets.

Blind rivet assemblies consisting of one piece of the same material are known from Swiss Patent Specification No. 501,846. The material is aluminium, copper, soft steel and also synthetic plastics. The functioning of this blind rivet assembly may not be satisfactory, particularly in the plastics version, because plastic material does not permit of a deformation such as would be necessary in this case. If it is a hard plastics material, the blind rivet assembly may break in the course of the setting, and if it is a soft plastics material, the blind rivet will return to its previous form after setting, due to the elasticity of the plastics material.

Known blind rivet assemblies according to Austrian Patent Specification No. 222,436 consist of two materials. They comprise a tubular rivet with a head of a relatively soft material such as e.g. soft steel. A set mandrel of hard material, e.g. tool steel, is detachably joined to the tubular rivet. The mandrel protrudes from the tubular rivet by its free end, the pull shank being at the sethead end of the tubular rivet, so that the pull shank can be clamped in known riveting devices. At the other end the mandrel has

a thickened head which is larger than the cylindrical or frusto-conical opening of the passage of the tubular rivet; after the thickened head, viewed in the direction of the pull shank, the mandrel is provided with a rib, a milled shank section, another rib, a preset breaking point and an upsetting cone. These various parts of the mandrel have different diameters all of which are greater than that of the shank. When the blind rivet assembly is set, the upsetting or widening cone plastically widens the opening of the passage of the tubular rivet, and the thickened head of the mandrel forms a snap head with the tubular rivet. After the formation of the snap head, the shank breaks away from the mandrel at the preset breaking point.

However, these blind rivet assemblies cannot be used for fixing elements of various kinds. Moreover, these known blind rivets cannot be removed. The tubular rivet and the mandrel must be manufactured separately and then assembled to form the blind rivet. Consequently they are expensive.

According to the present invention there is provided an injection-moulded blind rivet assembly made of thermoplastic synthetic plastics material and comprising a rivet and a setting mandrel injection-moulded to be integral and in one piece together, the rivet having a tubular body with at one end a rivet head and at the other a tail end, a breakable connection between the tail end of the rivet and a cylindrical pull shank of the mandrel, the pull shank extending through the tubular body from the breakable connection and substantially uniformly spaced from the inner wall of the body, the pull shank extending to beyond the rivet head, a thickened head of the mandrel having a dia-

meter greater than that of the pull shank and greater than that of the inner wall of the tubular body prior to retraction of the mandrel, the mandrel head and the pull shank being unfitted by a narrowed portion of the mandrel positioned along the mandrel between the breakable connection and the mandrel head and constituting a break-away joint, the thickened mandrel head being adapted upon retraction of the pull shank to enter, after breaking of the breakable connection, through the tail end of the rivet into the tubular body to form a snap-head and the break-away joint being so located that when it fractures upon continued retraction of the pull shank after the snap-head has been formed the joint lies wholly in the tubular body of the rivet between the rivet head and the tail end. If desired the blind rivet assembly may take the form wherein prior to retraction of the mandrel the breakable connection comprises a portion adjacent the pull shank of lesser strength than a portion adjacent the tubular wall and one such connection tapers radially inwardly to be axially thinner adjacent the pull shank than adjacent the tubular wall.

It is to be understood that the blind rivet assembly of this invention has a rivet head of conventional form or has a rivet head constituting part of a fixing element, the former being illustrated by Figures 1 to 3 of the accompanying drawings and the latter being illustrated by the remainder of the drawings hereinafter described.

The head of the mandrel may be spherical or have a frustoconical portion ending in a part-spherical portion of a diameter greater than the internal diameter of the tubular rivet.

It is possible to manufacture blind rivet assemblies according to the invention with simple tools as mass-produced parts with the use of thermoplastic synthetic material in injection moulding machines. In this way the blind rivet assemblies can be produced at advantageous cost and can be sold at a low price. Due to the use of synthetic plastics material, the blind rivets are non-corrosive and resistant to ageing. The blind rivets can be set with a simple riveting tool, they absorb high metal sheet and hole tolerances, and should form a secure tight riveted joint since the snap head from the mandrel head is almost completely enclosed. Moreover the blind rivet can also be used for securing elements such as e.g. trim fastening or cable clips.

Particular embodiments of the invention will now be described by way of example only with reference to the accompanying drawings, wherein:

Figs. 1 to 3 show steps in the use of a first embodiment of blind rivet assembly for blind riveting;

Figs. 4 to 6 show steps in the use of a second embodiment of blind rivet assembly as part of a fixing element in the form of a trim strip fastening;

Figs. 7 to 9 show steps in the use of a third embodiment of blind rivet assembly as a part of another fixing element in the form of a cable clip;

Figs. 10 to 12 show steps in the use of a fourth embodiment of blind rivet assembly as part of a further fixing element in the form of a tube clip.

Fig. 1 shows a blind rivet assembly in the starting state, where it has been inserted into the bores of two metal sheets 8 and 9 to be riveted together. The blind rivet assembly is in one piece and includes a tubular rivet 1 and a set mandrel 4, and the entire blind rivet assembly is injection moulded, in one piece from thermoplastic synthetic material. The tubular rivet 1 consists of a set head 2 and a sleeve part 3 having at its other end an internal bead 12. The mandrel 4 consists of a pull shank 5 and an enlarged head 6, with a narrowed breaking groove 7 therebetween constituting a break-away joint breakable as the mandrel 4 is retracted. The diameter of head 6 is greater than the internal diameter of sleeve 3. The bead 12 is connected to the pull shank 5 by a breakable connection 11.

For setting the rivet, one of the many known riveting tools is used. However, the riveting tool is not illustrated in the interest of clarity. During the formation of snap head 10 (see Fig. 3) the mouth-piece of the riveting tool rests against the set head 2 of the blind rivet, the pull shank 5 of the mandrel 4 being pulled into the riveting tool, as indicated by the arrows in Figs. 1 and 2.

Fig. 2 shows an intermediate stage between the initial form of the blind rivet (Fig. 1) and the finished blind riveting (Fig. 3). Due to the retraction of the pull shank 5 of the mandrel 4, the breakable connection 11 between the mandrel 4 and the integrally moulded bead 12 of the sleeve part 3 of the tubular rivet 1 breaks, the sleeve part 3 spreads on the head 6 of the mandrel 4. The head 6 of the mandrel 4 may be spherical or provided with a cone, as shown in Fig. 4. The breakable connection 11 may be a continuous join around the mandrel 4 or it may be in the form of a spider, or any other suitable form.

After this stage the head 6 of the mandrel 4 is pulled further into the sleeve part 3 of the tubular rivet 1 until the metal sheets 8 and 9 are firmly pressed together; in the course of this operation the sleeve part 3 together with the bead 12 has placed itself firmly around the head 6, together forming a snap head 10.

When the snap head 10 has been formed in this way and no further deformation can

take place, the mandrel 4 breaks away from the head 6 of the mandrel 4 at the breaking groove 7 as the pull continues to increase.

The final stage of the completely set blind rivet has thus been reached. If the blind rivet should ever have to be removed, the head 6 can be knocked out, for example, with a punch, and the tubular rivet can then be pulled out since it consists of thermoplastics material and consequently returns to its original form.

Figs. 4 to 6, 7 to 9 and 10 to 12 illustrate in analogy with Figs. 1 to 3 three embodiments of a blind rivet assembly as part of a fixing element based on the same principle, wherein the set head of the tubular rivet is part of the fixing element. Thus in the embodiment of Figs. 4 to 6 the set head is in the form of a trim strip clip 13 for fastening trim strips 14 relative to a metal sheet, e.g. on a motor vehicle.

Figs. 7 to 9 show a head in the form of a cable clip 15 for securing cables 16.

Another embodiment according to Figs. 10 to 12 shows the securing of two tubes 18 in a double tube clip 17. It is also shown that the head 6 of the mandrel 4 may consist of a cone 6a provided with a part-spherical head 6b as an alternative to the spherical head 6.

The setting or fastening of these illustrated fixing elements is carried out in the way described with reference to Figs. 1 to 3, the blind fastening elements according to Figs. 4 to 12 having a double function, i.e. of blind riveting and of offering a fastening. Fig. 10 shows on the right hand side a stage in the retraction of the mandrel.

Thus it can be seen that the blind rivet assembly as described above, for example for fixing elements, can be mass-produced in a simple process; can be processed in one operation with an inexpensive tool; which is very securely seated because of a faultless locking of the mandrel head in the snap head formed; which ensures tightness, for example, watertightness; and which can be removed in a simple and easy operation. Moreover, the snap head should be visually satisfactory and the blind rivet assembly should be non-corrodible.

#### WHAT WE CLAIM IS:—

1. An injection-moulded blind rivet assembly made of thermoplastic synthetic plastics material and comprising a rivet and a setting mandrel injection-moulded to be integral and in one piece together, the rivet having a tubular body with at one end a rivet head and at the other a tail end, a breakable connection between the tail end of the rivet and a cylindrical pull shank of the

mandrel, the pull shank extending through the tubular body from the breakable connection and substantially uniformly spaced from the inner wall of the body, the pull shank extending to beyond the rivet head, a thickened head of the mandrel having a diameter greater than that of the pull shank and greater than that of the inner wall of the tubular body prior to retraction of the mandrel, the mandrel head and the pull shank being united by a narrowed portion of the mandrel positioned along the mandrel between the breakable connection and the mandrel head and constituting a break-away joint, the thickened mandrel head being adapted upon retraction of the pull shank to enter, after breaking of the breakable connection, through the tail end of the rivet into the tubular body to form a snap-head and the break-away joint being so located that when it fractures upon continued retraction of the pull shank after the snap-head has been formed the joint lies wholly in the tubular body of the rivet between the rivet head and the tail end.

2. A blind rivet assembly according to Claim 1, wherein prior to retraction of the mandrel the breakable connection comprises a portion adjacent the pull shank of lesser strength than a portion adjacent the tubular wall.

3. A blind rivet assembly according to Claim 2, wherein the breakable connection tapers radially inwardly to be axially thinner adjacent the pull shank than adjacent the tubular wall.

4. A blind rivet assembly according to any preceding claim, wherein the thickened head of the setting mandrel is substantially spherical.

5. A blind rivet assembly according to any one of Claims 1 to 3, wherein the head of the setting mandrel has a frustoconical portion ending in a part-spherical portion of a diameter greater than the internal diameter of the tubular rivet.

6. A blind rivet assembly according to any one of the preceding claims, wherein the rivet head is in the form of a fixing element.

7. A blind rivet assembly according to Claim 6, wherein the fixing element is a cable or tube-receiving clip.

8. A blind rivet assembly according to Claim 6, wherein the fixing element is a trim-securing clip.

9. A blind rivet assembly substantially as herein described with particular reference to Figs. 1 to 3, Figs. 4 to 6, Figs. 7 to 9 or Figs. 10 to 12 of the accompanying drawings.

10. An article blind-riveted by means of a blind rivet assembly as claimed in any one of the preceding claims.

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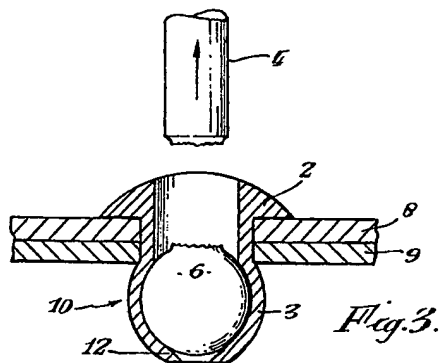
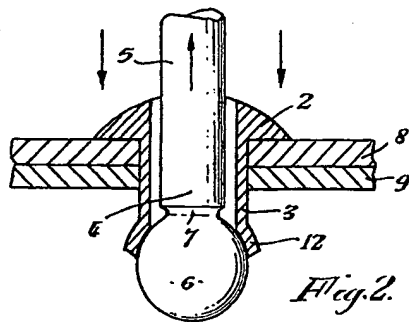
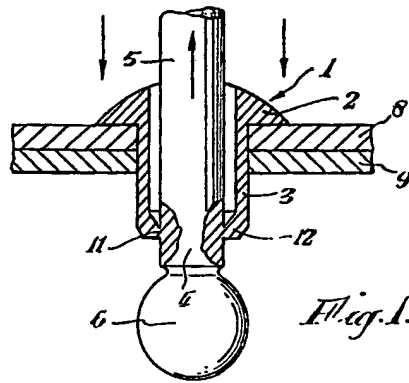
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4 SHEETS

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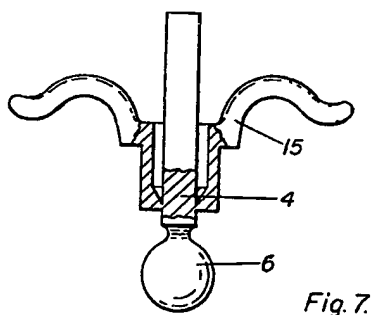
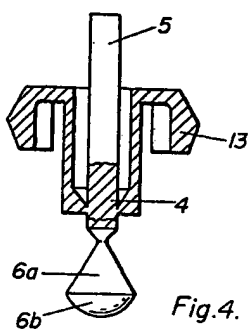
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4 SHEETS

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Sheet 2



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